How the Waste-to-Energy industry contributes to Energy Efficiency across Europe

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Brussels , 5th November 2013

Topics for this session

- Waste to Energy: current practice and outlook
- Drivers for improvement of energy efficiency
- Three recent examples of innovative projects
- What do we learn from this?

CEWEP

Confederation of European Waste-to-Energy Plants

CEWEP represents 378 of 454 Waste-to-Energy plants across Europe. (66 mt of EU capacity of 78 mt in 2011)

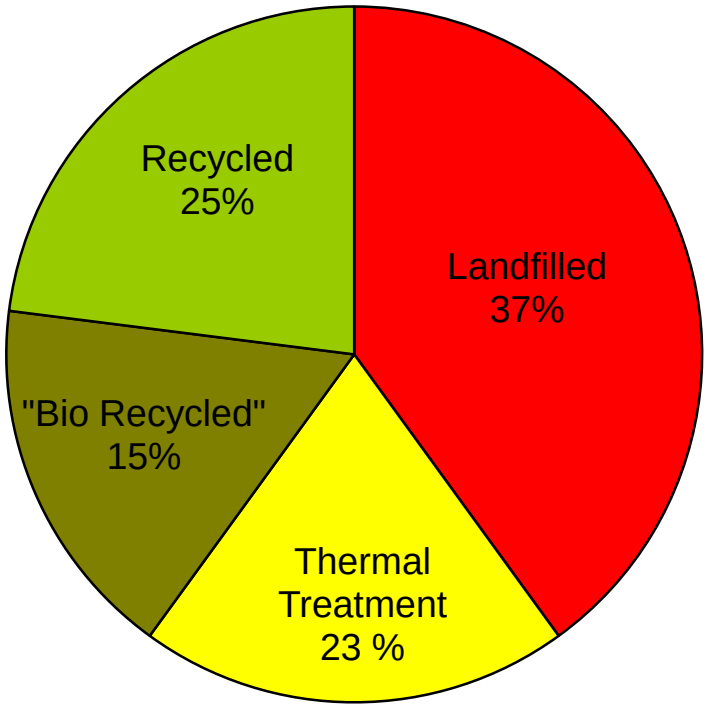
They thermally treat household and comparable waste, which is not otherwise reused or recycled, and generate energy from it.

In 2011 across Europe they supplied:

30 TWh electricity (6 m hholds)

58 TWh of heat. (5 m hholds)

Treatment of MSW in Europe EU27, 253 m tpa in 2011



Treatment of Municipal Solid Waste in the EU 27 in 2011
Source: EUROSTAT

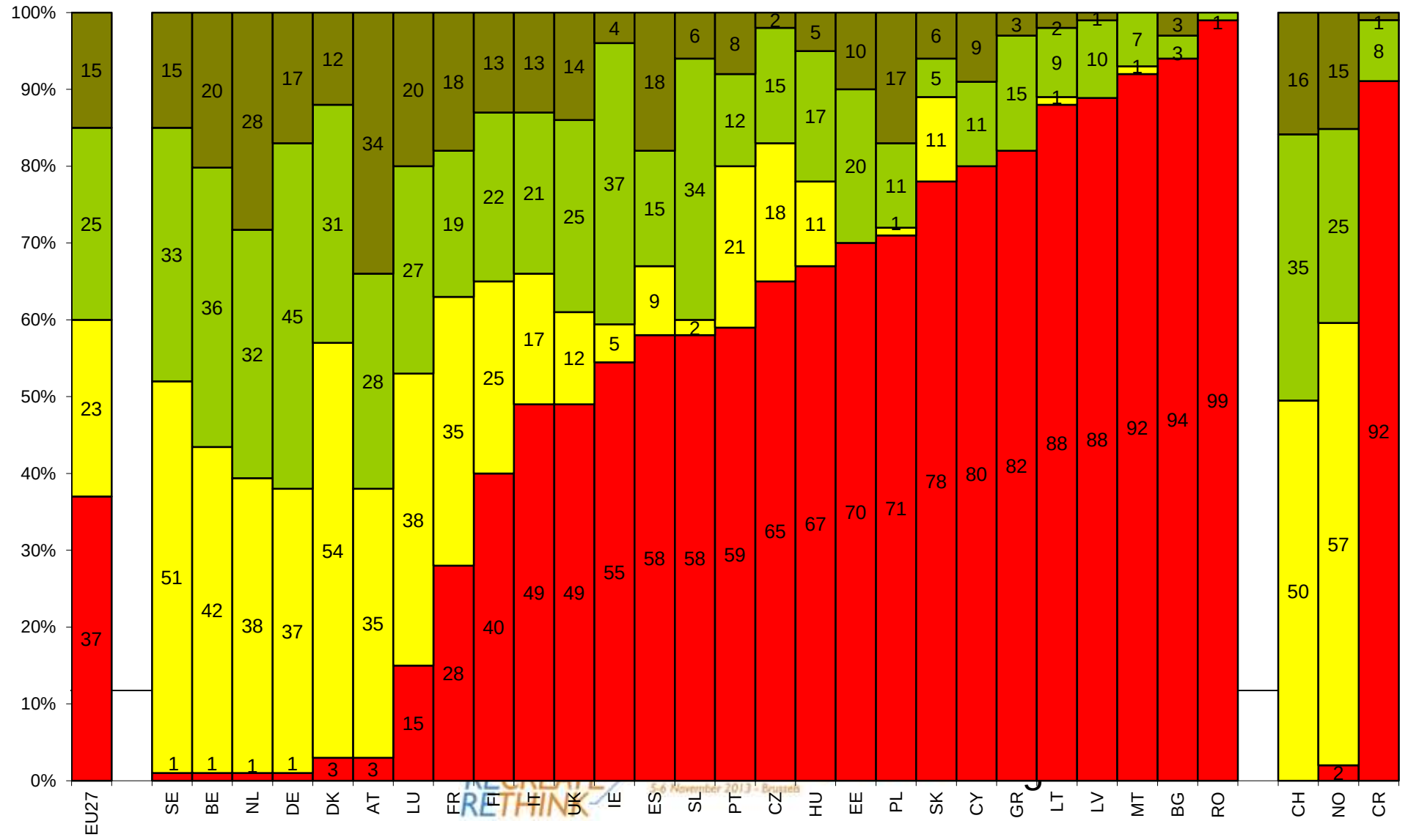
A large part of the EU27 waste is still wasted by putting it on landfills with negative effects on the environment.

But waste is a precious resource which should be utilised!

Treatment of MSW across Europe in 2011

Source: EUROSTAT Graph created by CEWEP

Recycling | Bio-Recyling" | Thermal Treatment | Landfilling



Waste to Energy in Europe

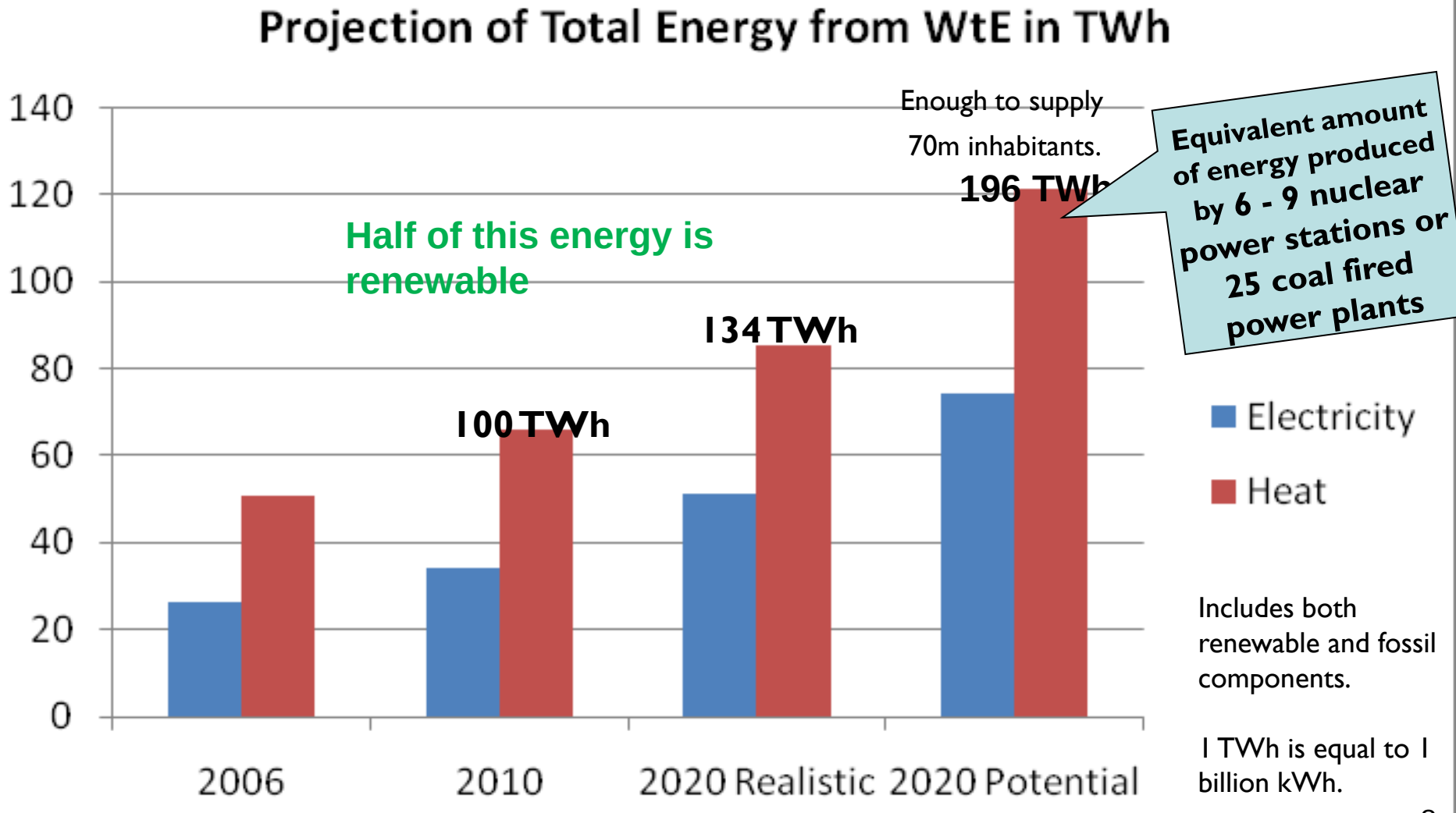
(Incineration with Energy Recovery of MSW and comparable waste)

- Dominant route for the treatment of **residual** waste (and of RDF or sorting residues)
- Fully proven and environmentally safe thanks to FGC
- About 78 million tonnes of capacity in operation in 2011 supplying about 30 TWh of electricity (6 million hh) and about 58 TWh of heat (5 million hh)
- About 50 % of this energy is classified as renewable
- represents a net CO_2 saving and avoids the use of fossil fuels elsewhere for energy production

Application of Power and Heat in Europe

- **Production of Electricity is obligatory**; Older plants have modest electrical efficiency; Newer plants designed for optimum electrical efficiency (steam conditions, turbine type)
- Supply of electricity to the grid, or local customer
- Supply of high pressure **steam to industrial** customer nearby e.g. paper company, chemicals plant, water desalination, cooling
- Supply of hot water/ low pressure steam to district heating system e.g. in Nordic, NL DE, CR, Paris
- Maximum Energy Efficiency can be achieved by **combination of supply of Power and Heat**

Sustainable Energy potential from WtE



Which are the drivers for improvement of Energy Efficiency of WtE plants ?

- The wish to contribute to local/ regional initiatives to save GHG emissions and use renewable energy
- To make sure the WtE plant R1 value is increased: classification of the plant as Recovery in the Waste Framework Directive
- Economic reasons: income from Energy can offset lower income from waste treatment

Agreed formulae within the WFD for the R1 Efficiency criterion

Treatment of waste in a WtE plant is **recovery** if:

An existing plant meets efficiency factor > 0,6
New plant (from 2009) meets efficiency factor > 0,65

Energy efficiency formulae:

$$\frac{\text{Energy produced} - (\text{Energy in added fuel} + \text{Energy import})}{0{,}97^{*} \times (\text{Energy in the waste} + \text{Energy in added fuel})}$$

Equivalency factor electricity production x 2,6

Equivalency factor heat exported x 1,1

* factor accounting for energy losses due to bottom ash and radiation

Three recent examples of innovation in supply of heat by the WtE industry

- The supply of heat and steam by Twence to local industry and local district heating systems (NL)

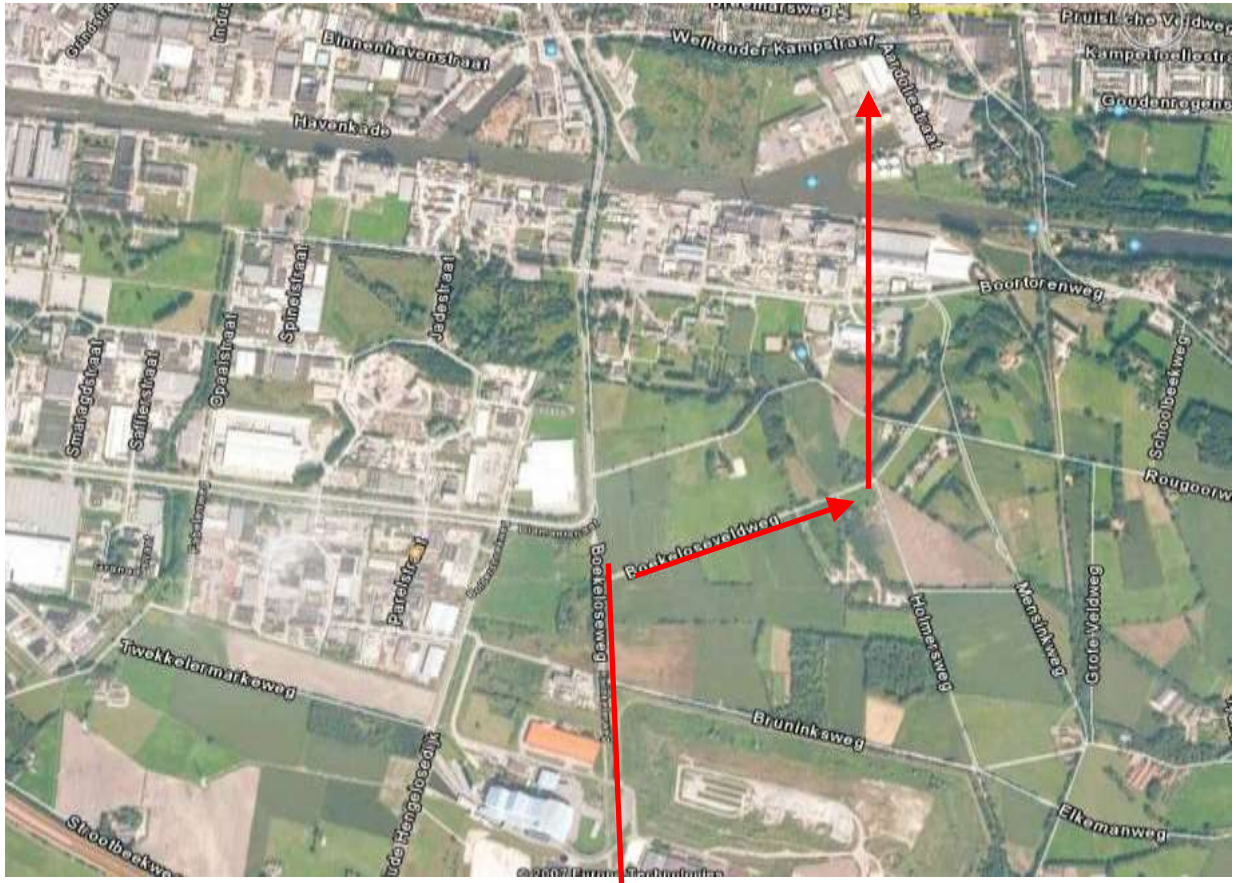
  This initiative won a 2013 Global District Energy Award in the category "Modernisation of existing networks"

- The Rotterdam Botlek steam supply network and the Rotterdam district heating network

- Mobile storage of heat from a WtE plant in Hamm, Germany

The Twence NL example

Steam supply by Twence to industrial customer AkzoNobel via 1.5 km supply line



Typical conditions:

Low pressure steam 4 bar 160 C

Max capacity 1500 kt/ a

Achievements 2012:

Supply 570 kt steam
CO2 saved 260 kt

Modernisation district heating Enschede with supply by Twence

- Example of good collaboration between various public and private partners
- Hot water supply via 5 km line to district heating
- Design for 80 MW th
- Major benefits CO2 and NOx reduction by 20 - 40 %
- Saving of natural gas of about 32 million m^3 / year

Examples from Rotterdam port area

Rotterdam has got major CO2 reduction ambitions:
50 % reduction by 2025 compared to 1990

One major pillar is heat and steam supply from AVR WtE plant

District heating Rotterdam supplied by AVR Waste to Energy Plant

- Project with many players involved
- Complexity of river crossings

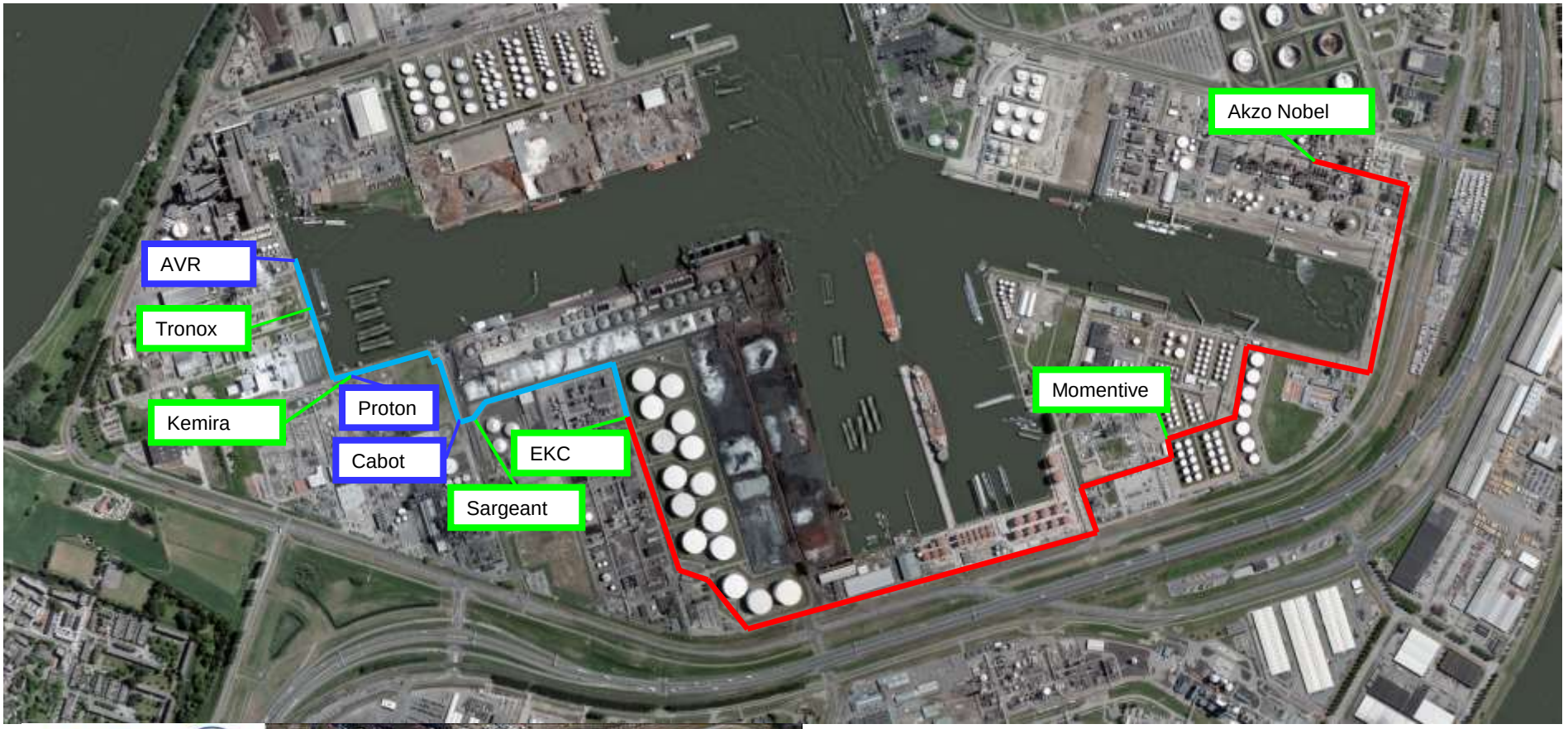
	Heat supply	Households	Timing	CO2 savings kt
South Branch 26 km	**100**	**50,000**	**Operational Sept 2013**	**80**
North Branch 16 km	**160**	**95,000**	**2014**	**>100**

Set up of steam “common carrier” in Botlek area

Steam supply to series of industrial plant, initially mainly fed by AVR Waste to Energy plant

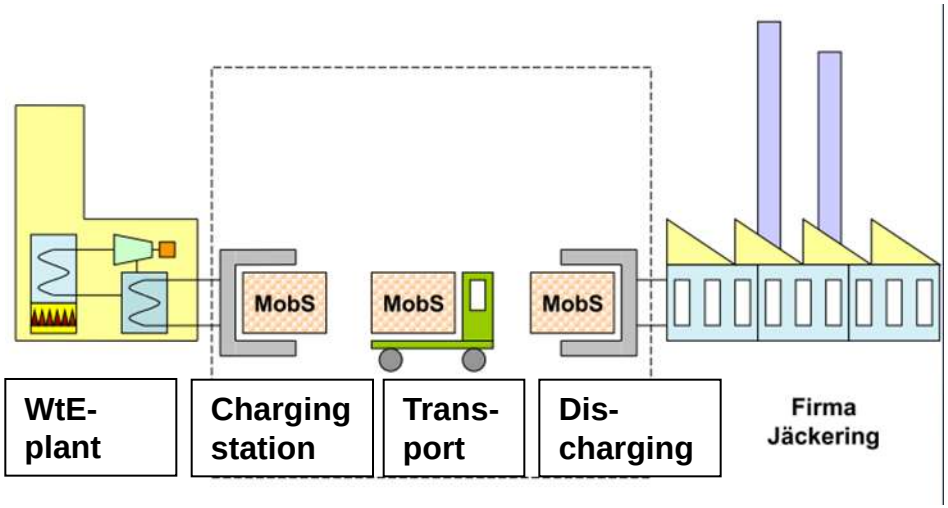
	Timing	Steam supply Kt/ a	CO2 savings Kt/a
Phase I West	**May 2013**	**300**	**70**
Phase II	**2015**	**300**	**> 50**
Total potential		**1200**	**200 - 400**

Steam supply link Botlek West and South



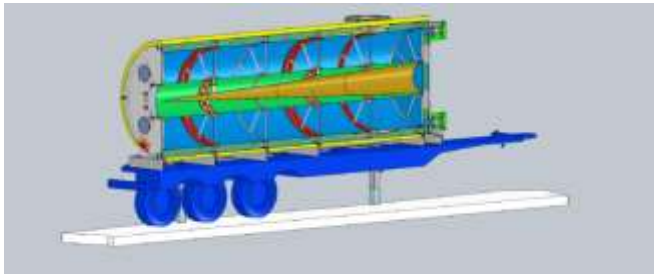
The West branch of the Botlek steam link has been operational since May 2012

Innovative mobile supply of heat from Hamm (DE) Waste to Energy Plant



Using heat as steam (135°C)

Mobile heat storage tank



Heat storage tank (System MVA Hamm):

- length: 8.350 mm, width: 2.490 mm
- Therm. capacity max. 240 kW
- Total stored therm. energy max. 2,4 MWh

Based on the high capital investments min. 5.000 operational hours (200 heat deliveries) are required.

goal: heat price less than 40 €/MWh

First container was constructed 2012

In operation since September 2012

Conclusions

- The WtE industry significantly contributes to major energy efficiency improvements by the supply of heat
- There are major opportunities for the supply of both hot water for district heating and of steam to nearby industry
- The innovation often is in bringing about long term collaboration between various public and private partners (more complex since liberalisation of energy markets)
- Heat supply opportunities should be a key factor for the siting of greenfield WtE initiatives

Thank you for your attention !

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